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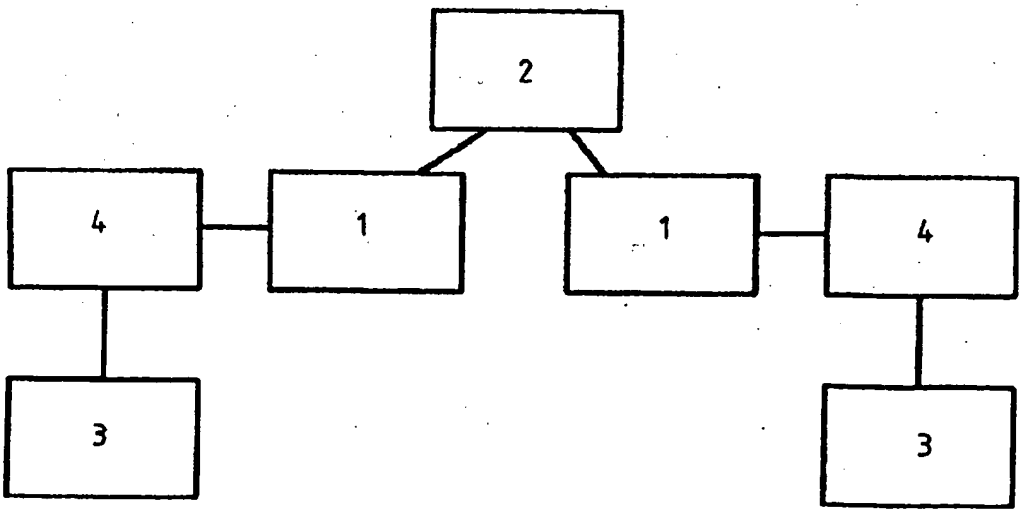

(57) Abstract

A system for communication of feelings comprises at least one computer, a sensor array for detecting touch by a user and delivery sensor signals, an actuator array for delivering physically perceptible taction signals to a user, and a control unit, which links the sensor array and the actuator array to the computer. The control unit converts the sensor signals into taction signals capable of being processed by the computer, which indicate at least the location of the sensor(s) being touched, and which converts taction signals received from the computer into control signals for the actuator(s), which are present at the location in the actuator array which is indicated by the taction signals.

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System for communication of feelings

The invention relates to a system for communication of feelings with a computer.

With the known systems it is possible to communicate with a computer, or, in a computer network comprising two or more computers, with other users through said computers by transferring textual, visual and auditive information. The visual information may be quasi-three-dimensional, if desired. To date it has not been possible to transfer physical feelings or physical tactile sensations when communicating with computers or through computers.

The object of the invention is to provide a system of the kind referred to in the introduction, wherein the transfer of physical feelings or physical tactile sensations when communicating with of through computers is possible in a relatively simple manner.

In order to accomplish that objective the invention provides a system for communication of feelings comprising at least one computer, a sensor array for detecting touch by a user and delivering sensor signals, an actuator array for delivering physically perceptible taction signals to a user, and a control unit, which links the sensor array and the actuator array to the computer, which control unit converts the sensor signals into taction signals capable of being processed by the computer, which indicate at least the location of the sensor(s) being touched, and which converts taction signals received from the computer into control signals for the actuator(s), which are present at the location in the actuator array which is indicated by the taction signals.

In this manner a system is obtained wherein a user can deliver taction signals to the computer by touching one or more sensors, whilst taction signals received from the computer can be converted into physically perceptible taction signals by one or more actuators. If the computer is

suitably programmed this makes it possible to feel an illustration displayed on the screen, as it were. With computer games the user can furthermore take part physically as one of the illustrations on the screen, as it were, because the tactile sensations can be transferred via the sensors and the actuators.

According to a preferred embodiment of the invention the system comprises two or more computers which are connected to a network, wherein each computer comprises a sensor array for detecting touch by a user and delivering sensor signals, an actuator array for delivering physically perceptible taction signals to a user, as well as a control unit, which couples the sensor array and the actuator array to the associated computer, wherein the computer comprises means for converting the taction signals emanating from the associated control unit into network taction signals intended for one or more computers, as well as means for converting network taction signals received from the network into taction signals for the associated control unit.

This makes it possible for the user who touches one or more sensors to transfer this touch or the tactile motion to another user, who may be located at a (very) large distance.

The invention will be explained in more detail with respect to the drawing, which shows a very diagrammatic embodiment of the system according to the invention.

Fig. 1 is a strongly simplified block diagram of an embodiment of the system according to the invention, wherein the sensor array and the actuator array are combined in a sensor-actuator assembly.

Fig. 2 is a strongly simplified plan view of the sensor-actuator assembly of Fig. 1.

Fig. 3 is a diagrammatic sectional view of one sensor-actuator pair of the assembly shown in Fig. 2.

Fig. 4 shows an embodiment of the control unit of a computer from the system shown in Fig. 1.

Fig. 5 is a strongly diagrammatic view of an alternative embodiment of a sensor-actuator pair.

Fig. 1 very diagrammatically shows a system for communication of feelings, wherein two or more computers 1 are connected to a computer network 2, for example the Internet. Although only two computers 1 are shown in Fig. 1, it will be apparent that usually a large number of computers will be connected to network 2 in practice. A sensor-actuator assembly 3 is connected to computer 1 via a control unit 4. Control unit 4 may be in the shape of a separate apparatus or as a plug-in card, which is mounted in the computer. An array of sensors and an array of actuators are joined in sensor-actuator assembly 3, wherein said sensors and said actuators are arranged in a matrix of rows and columns as sensor-actuator pairs 5, as is diagrammatically indicated in Fig. 2. In the described embodiment a switch means 6 is added to each sensor-actuator pair, which connects the sensor 7 or the actuator 8 of a pair 5 to the associated row and column wires 9, 10, which are connected to a common row connecting wire 11 and a column connecting wire 12 respectively. Sensor-actuator assembly 3 is connected to control unit 4 via said connecting wires 11, 12.

Sensors 7 may for example consist of touch-sensitive switches, which are known per se, or the like. Actuators 8 may for example be configured as shown in more detail in Fig. 3. A coil 14 is wound on a miniature core 13, which coil moves a pin 15 up upon excitation. The actuators are covered by a flexible membrane 16, so that a user who puts his hand on membrane 16 will be able to clearly perceive a tactile stimulus from a pin 15. Sensors 7 configured as touch-sensitive switches may be incorporated in said membrane 16. Furthermore wires 17 are present for supplying power to the coils, as is diagrammatically indicated in Fig. 2. Fig. 3 shows a likewise flexible base membrane 18, which supports actuators 8.

The sensors 7 of the sensor-actuator assembly are capable of detecting touch by the user in the above-described manner, and accordingly deliver sensor signals to control unit 4 via connecting wires 11, 12. This control unit converts the sensor signals into taction signals in the form of a suitable binary code, for example, which can be processed by computer 1 and in which at least the location of the sensor (sensors) being touched is stored. If pressure-sensitive sensors are used, also the force of the touch can be stored in the code. Control unit 4 comprises a sensor matrix interface 19, which transmits the binary code to a command interpreter 20, which in turn transmits the binary code in a suitable form to computer 1 via a communication interface 21.

In a corresponding manner it is possible to transmit taction signals from computer 1 via communication interface 21 and command interpreter 20 to an actuator interface 22, which converts the taction signals into control signals for actuators 8, which are present at the places in the actuator matrix that are indicated by the taction signals.

Computer 1 runs a programme, possibly in combination with special hardware, which converts the signals from control unit 4 into information for transmission via computer network 2, or which converts the information from computer network 2 into taction signals for control unit 4. Computer 1 may furthermore include suitable software and/or hardware, by means of which the taction signals are converted into visual and/or auditive signals, which are processed in a usual manner by computer 1 in order to produce images and/or sound.

From the foregoing it will be apparent that the above-described system enables the transfer of feelings or tactile sensations between users of computers 1 by means of computers 1 and network 2. Said transfer of tactile sensations is called communication of feelings herein. When a user moves a finger across sensors 5, for example,

this will lead to sensor signals being delivered to control unit 4, which converts said sensor signals into corresponding taction signals, which are converted by computer 1 into information which is transferred via network 2 to another computer 1, with which a connection has been made by means of a communication programme known per se. In said other computer 1 the information being received is converted into taction signals, which are converted, via control unit 4, into control signals for actuators 8, which are located at the place in the actuator matrix that is indicated by the taction signals. Actuators 8 transfer the touching of sensors 7 by one user to the user of the other computer 1.

Although a sensor-actuator assembly 3 is used in the above-described embodiment, it is also possible to configure sensors 7 and actuators 8 as separate matrix units, if desired. Control unit 4 may also consist of two separate parts in this case. The separate units or the assembly 3 are preferably integrated in a flexible membrane-like carrier. It is possible to make an article of clothing from such a carrier, so that the touching of the sensors 7 can take place on a selected part of the user's body.

The above-described system in not only suitable for transferring tactile sensations from one user to the other, but it may also be used for communication of feelings with one computer 1. In that case said computer 1 is provided with suitable hardware and/or software, which converts taction signals into graphic illustrations and/or which converts graphic illustrations into taction signals. This enables communication of feelings, for example when playing computer games or the like, with the player who participates in the game as one of the players. Furthermore it is possible to programme the computer in such a manner that textual information is converted into taction signals, which form corresponding braille signs, so that text can be made legible for blind people. In this manner blind people can furthermore feel graphic illustrations, as it were.

According to an advantageous embodiment the excitation of the actuators according to Fig. 3 takes place by an excitation current which causes pin 15 to move up and down, as a result of which a stronger stimulus is transferred to the user. It is noted that the actuator 8 shown in Fig. 3 merely serves as an example. Fig. 5 very diagrammatically shows an alternative actuator in the shape of a pair of electrodes 23, whereby a physical stimulus is obtained by generating a tension between said electrodes 23. The same electrodes may function as sensors 7. Also with such embodiments of the actuator it is possible to influence the stimulus communicated to the user by suitably selecting the waveform, the frequency and the amplitude of the excitation current.

The invention is not limited to the above-described embodiment, which may be varied in several ways within the scope of the claims.

CLAIMS

1. A system for communication of feelings comprising at least one computer, a sensor array for detecting touch by a user and delivering sensor signals, an actuator array for delivering physically perceptible taction signals to a user, and a control unit, which links the sensor array and the actuator array to the computer, which control unit converts the sensor signals into taction signals capable of being processed by the computer, which indicate at least the location of the sensor(s) being touched, and which converts taction signals received from the computer into control signals for the actuator(s), which are present at the location in the actuator array which is indicated by the taction signals.

2. A system according to claim 1, wherein said sensor array and said actuator array are combined in a sensor-array assembly.

3. A system according to claim 1 or 2, wherein two or more computers are connected to a network, wherein each computer comprises a sensor array for detecting touch by a user and delivering sensor signals, an actuator array for delivering physically perceptible taction signals to a user, as well as a control unit, which couples the sensor array and the actuator array to the associated computer, wherein the computer comprises means for converting the taction signals emanating from the associated control unit into network taction signals intended for one or more computers, as well as means for converting network taction signals received from the network into taction signals for the associated control unit.

4. A system according to any one of the preceding claims, wherein said sensor array and/or said actuator array or the sensor-actuator assembly, as the case may be, are integrated in a flexible membrane-like carrier.

5. A system according to claim 4, wherein said membrane-like carrier is in the form of an article of clothing.

6. A system according to any one of the preceding claims, wherein the computer comprises means for converting graphic images into taction signals and/or for converting taction signals into graphic images or text and/or for converting text into taction signals forming corresponding braille signs.

7. A system according to any one of the claims 3 - 6, wherein the computer comprises means for converting taction signals into visual and/or auditive signals to be processed by the computer.

8. A system according to any one of the claims 2 - 7, wherein the sensor-actuator assembly comprises a matrix of sensor-actuator pairs with a matrix of row and column wires connected to common row and column connecting wires, which are connected to the control unit, wherein a switch means is added to each sensor-actuator pair, which switch means connects said sensor or said actuator to the matrix wires.

9. An assembly of sensors comprising sensors arranged in a matrix, which function to detect touch by a user and deliver sensor signals.

10. An actuator assembly comprising actuators arranged in a matrix, which function to deliver physically perceptible taction signals.

11. An assembly of sensor-actuator pairs arranged in a matrix, wherein each sensor-actuator pair is arranged for detecting touch by a user and delivering sensor signals or physically perceptible taction signals to the user.

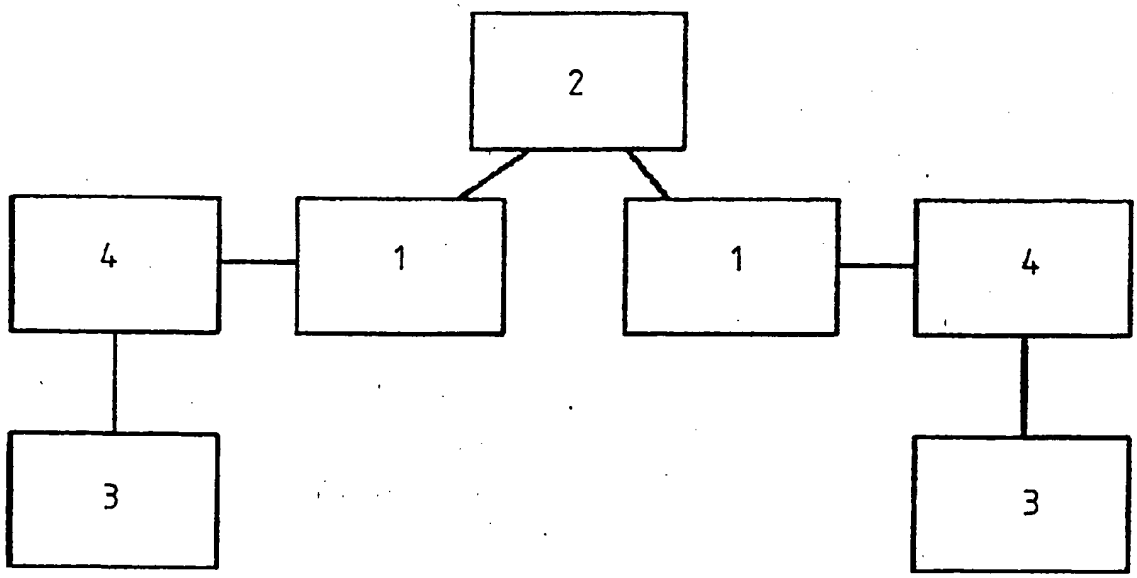

fig. 1

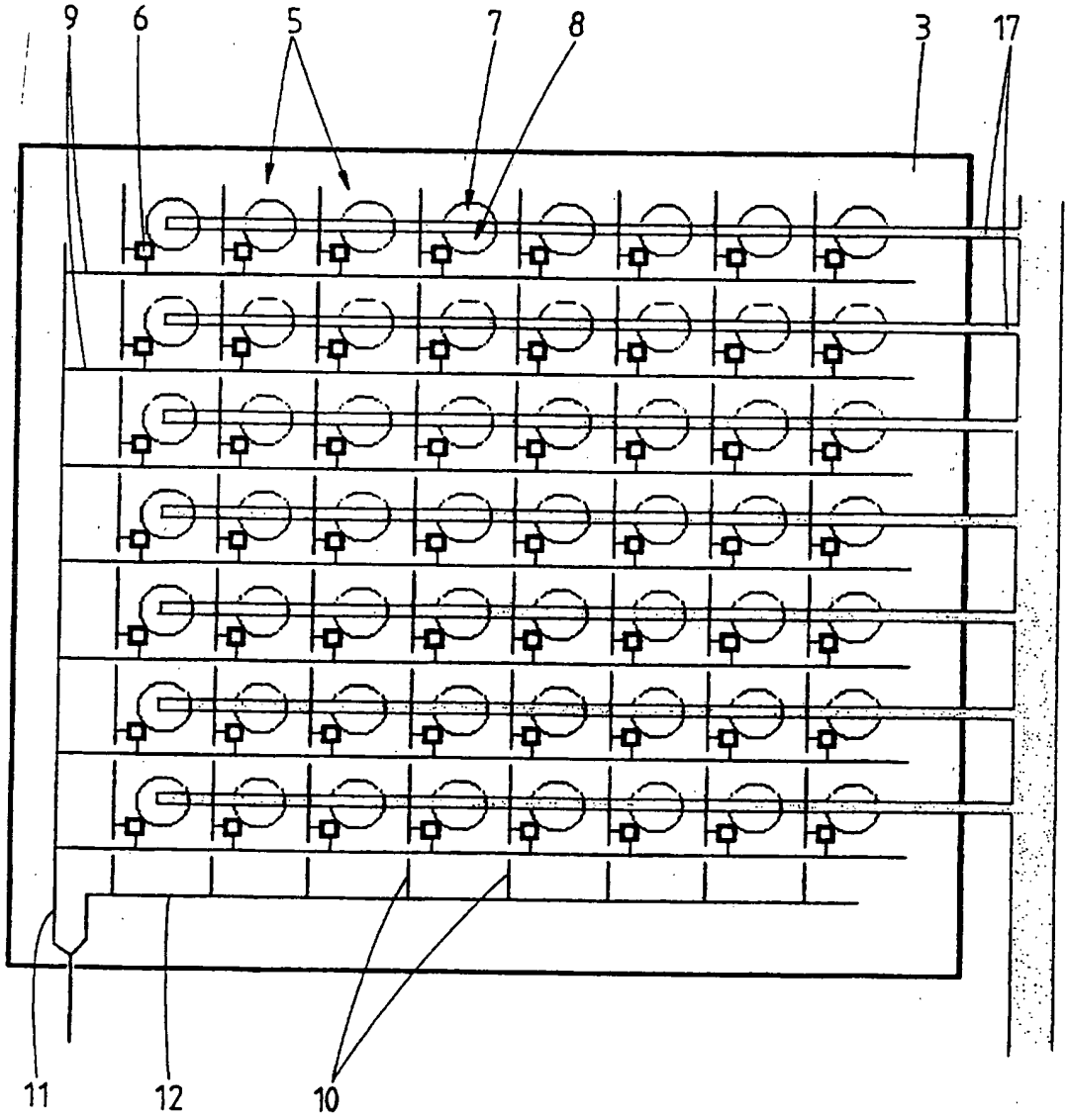

fig. 2

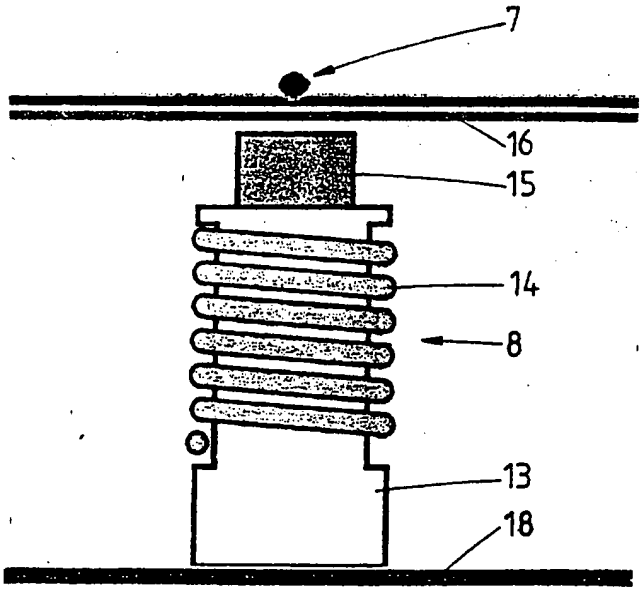

fig. 3

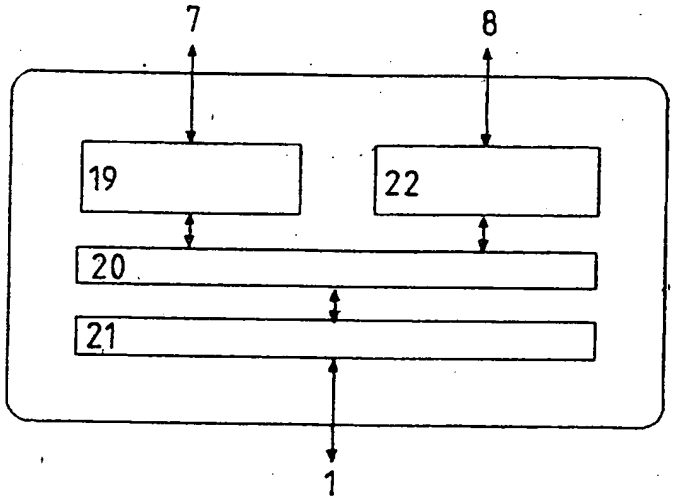

fig.4

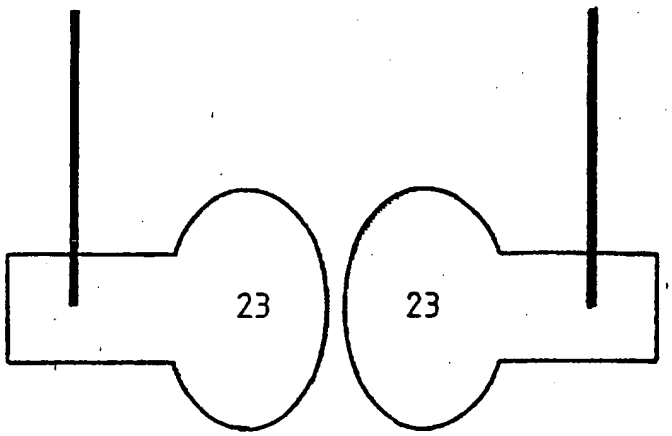

fig. 5

INTERNATIONAL SEARCH REPORT

Inte ional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F3/00 G09B21/00

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F G09B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WEBER G: "READING AND POINTING - MODES OF INTERACTION FOR BLIND USERS" 28 August 1989 , INFORMATION PROCESSING, SAN FRANCISCO, AUG. 28 - SEPT. 1, 1989, NR. CONGRESS 11, PAGE(S) 535 - 540 , RITTER G X XP000079105 see the whole document	1,2,6, 8-11
Y		
Y		3
	---	4,5
X	US 3 831 296 A (HAGLE E) 27 August 1974 see column 2, line 33 - column 4, line 58 see figures 1,3	1,3-5
A		2

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[X] Further documents are listed in the continuation of box C.

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18 December 1997	30/12/1997
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 096, no. 006, 28 June 1996 & JP 08 030189 A (HITACHI LTD), 2 February 1996, see abstract	1,2,9-11
A		8

X	DE 42 41 937 A (MATSCHULAT GUNNAR) 16 June 1994 see column 2, line 21 - column 7, line 41 see figures 1-7	1,6,7,10
A		2,3,9,11

X	US 3 612 061 A (COLLINS CARTER C ET AL) 12 October 1971 see column 2, line 16 - column 5, line 31 see figures 1,2	10
Y		4,5

Y	WO 95 08793 A (VIRTUAL UNIVERSE CORP) 30 March 1995 see page 3, line 36 - page 6, line 35 see figures 1,2	3
A		1,2,4,5

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.nformation on patent family members

Intr ·ional Application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3831296 A	27-08-74	NONE	
DE 4241937 A	16-06-94	NONE	
US 3612061 A	12-10-71	NONE	
WO 9508793 A	30-03-95	US 5659691 A	19-08-97
		AU 7736694 A	10-04-95
		EP 0721614 A	17-07-96
		JP 9503082 T	25-03-97